ps systec

SMART modbus

Digitize.
Assets. Sensors. Machines

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Modbus

IoT Solution

SMARTmodbus ETH

User guide

**Certified for
the Cloud of
Things**

Mobile Technology

NB-IoT LTE-M

1. Table of Contents

1 Safety

- Depending on its state of technology, each PSsystec product requires a testing/configuration/programming/commissioning phase so that it can be optimally adapted to the specific application. Failure to perform this phase may result in malfunctions for which PSsystec cannot be held responsible.

- This product may only be installed by qualified personnel.

- PSsystec assumes no liability for consequential damage caused by improper installation and handling of the products or their use.

- The end customer may only use the product in accordance with the specifications specified in the product specifications.
  in the ways described. In addition, there are the following points to consider for each PSsystec product:

  - The electronic circuits must not get wet. Rain, moisture, and any kind of liquid or condensate contain corrosive minerals that can damage the electronic circuits.
  - The product should be used or stored in environments that comply with the temperature and humidity limits specified in the manual.
  - The device must not be installed in particularly warm environments. Excessively high temperatures can reduce the lifespan of electronic devices, damage them, deform them or melt the plastic parts.
  - The device must not be opened in any other way than described in the manual.
  - The internal circuitry and mechanisms of the device can be irreparably damaged by drops, impacts and vibrations.
  - No corrosive chemical products, aggressive solvents or cleaning agents may be used to clean the appliance.
  - The product must not be used in any application environment other than as described in the Technical Manual.

- Ensure safety:

  - Work on electrical systems, only by an authorized electrician
  - Switch off mains disconnectors on all poles, secure against reconnection, check that there is no voltage.

- PSsystec's liability for its own products is governed by the general terms and conditions of contract and/or by specific agreements with customers. In accordance with applicable legislation, PSsystec and its employees shall not be liable for any loss of profits or sales, loss of data and information, cost of goods or substitute services, property damage or personal injury, business interruption or any direct, indirect, incidental, financial loss, insurance damage, punitive, special or consequential damages caused in any way, whether contractual, non-

contractual or arising out of negligence or other liability as a result of the installation, use or impossibility of use of the product, even if PSsystec has been notified of the possible damage. Contractual, non-contractual damages or those resulting from negligence or other liability resulting from the installation, use or impossibility of use of the product.

2 Environment

INFORMATION ON THE CORRECT TREATMENT OF ELECTRICAL AND ELECTRONIC WASTE

With regard to Directive 2002/96/EC of the European Parliament and of the of the European Council of 27 January 2003 and to the relevant national implementing provisions, we inform:

1. The components of the electrical and electronic equipment may be cannot be disposed of as municipal waste. The procedure of the waste separation.

2. For disposal, the public or private waste management systems envisaged use. In addition, after use, the device can be used in the purchase of a new product.

3. This device may contain hazardous substances: An improper Use or incorrect disposal can have negative consequences for human health and the environment.

4. The product or packaging and symbol contained in the owner's manual (crossed-out wheeled waste container) indicates that the device was placed on the market after 13 August 2005 and was therefore subject to the processes of waste separation.

5. In the event of improper disposal of the electrical and electronic waste, the penalties provided for by local waste management standards are imposed.

3 System description

Modbus TCP is a manufacturer-independent communication protocol and is one of the most widely used protocols in the fields of water management, energy management, air conditioning, compressed air technology and building automation. With the IoT solution SMARTmodbus, local Modbus systems and devices can be easily digitized.

Monitoring of plant technology

- Water management
- Energy technology
- Air conditioning
- Compressed air technology
- Building
- Environmental technology

Advantages

- **Remote Monitoring & ManagementReceive live information about the operation and status of the plant technology across locations.**
- **Manufacturer-independent digitalizationThe SMARTmodbus** reads system data from all Modbus-capable devices – regardless of the manufacturer.Thanks to the **Telekom PSA-certified transmission path** and the **Cloud of Things** , complete online configuration of the devices in the field is possible.
- **Independent of local ITThe certified radio transmission path does not require any local IT infrastructure**.
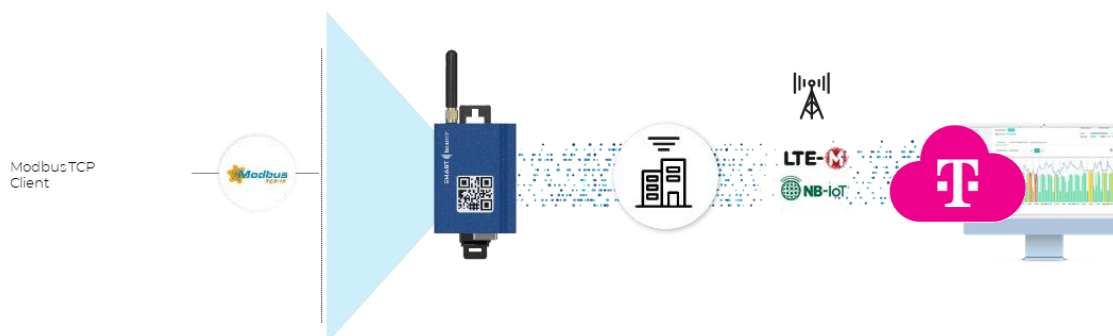
4 Mechanical installation

The SMARTbox mini offers the option of mounting on a DIN rail.

Din Rail Mounting Adapter
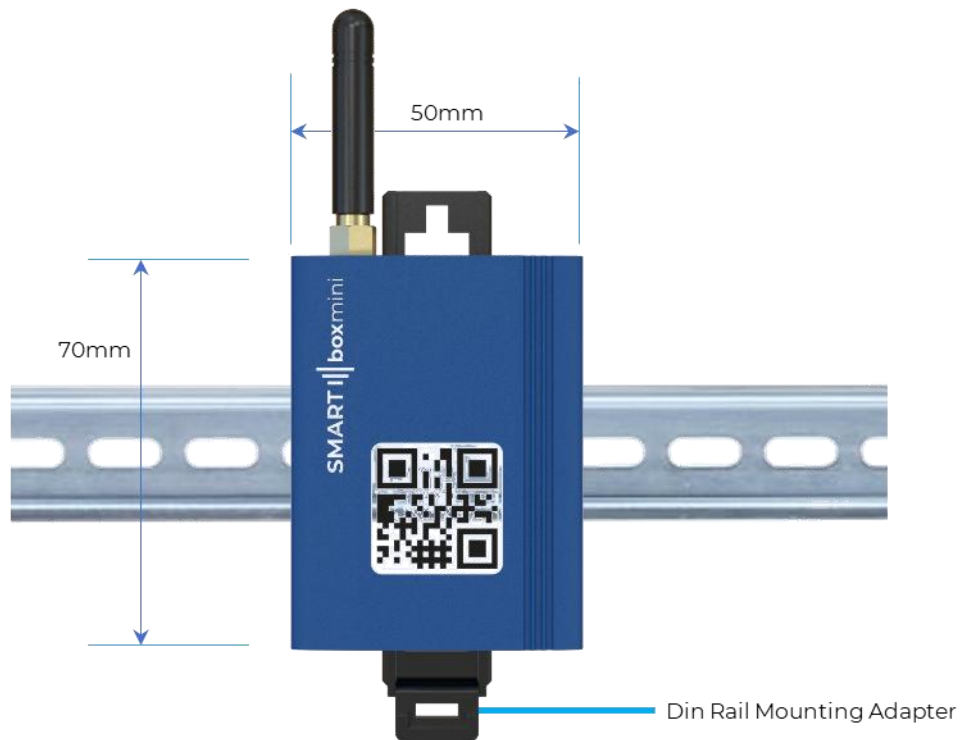
5 Electrical installation

5.1 Connection of power supply and mobile communications

- Standard SMA antenna connector for connecting an external antenna or stub antenna
- Slot for 2FF sim card (sim card is already ready for use in the IoT solution packages). The SIM card is inserted into the slot with the contact surface facing up and the mark on the front left (bevel on the SIM card) until it clicks into place.
- Power supply, connection via 2-pin header pitch 3.81mm
    - Nominal voltage range: 12-30 VDC, +/-10%
   - Maximum (average) continuous supply current: 300 mA at 12V, 150mA at 24V
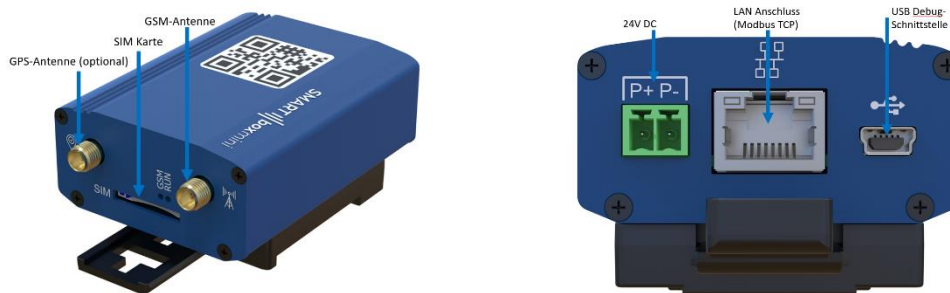
✎ The ramp-up of the unit takes about 60. When the "IOT and Run" LEDs flash, the unit is ready for use. Searching for the mobile network can take up to 15 minutes. If the IoT LED is still in the status of continuous lighting, either the SIM card is not activated, not engaged correctly or an external antenna must be used.

- Optionally, you can scan the SMARTbox with the Fieldapp to enter the technical location of the assemblies. Proceed as follows:

(1) Open the PSsystec Fieldapp under the Appswitcher either with a smartphone (Android or IOs) or directly on your laptop. To do this, you must have service access to the cloud platform:

(2) Scan the printed QR code on the SMARTbox or alternatively enter the serial number (IMEI) of the gateway.
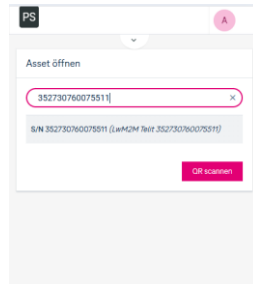
(3) After scanning, you will get the list of already connected and configured devices on the network. Each number represents a Modbus device.
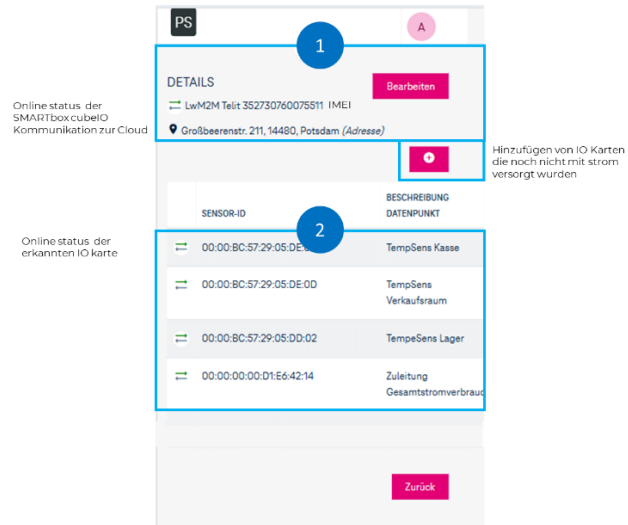
1. Online status of the SMARTbox. If the arrows are green, there is active communication with the cloud. Under "Edit" you can specify the location of the gateway and the membership of a group. The group can be, for example, a location:

2. Online status of the connected sensors.
   - All detected Modbus devices are listed here
   - Attention: the list updates automatically as soon as sensors are detected.
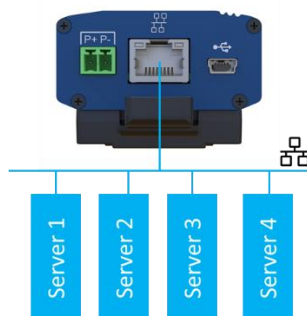
3. To store the master data of the IO card, you can either
   "+" find the sensor in question in the list displayed and click on the corresponding ID

5.2 Connection of the sensor system

Type Sensor	Modbus TCP Client
Connection	
Specification	A Modbus TCP client connection is available at the gateway with connection of max. 4 servers. Attention: When connecting directly to the server without a switch, a cross cable must be used

6   Activation/ Registration

Activation/registration is done via pssystec.com/registrierung

In this step, decide on a runtime package for mobile communications, data storage and notification via SMS.

You will then receive a link and a password to the e-mail address you have provided. You can then log in to your personal area in the online portal.

7   Dashboard

The dashboards provide an interface for creating, using, and reviewing individual functions.

The selection menu shown here can be reached by pressing on the square next to your name in the upper right corner of the screen.

Select the Plain cockpit to access the dashboards and the widgets placed on them (applications on the dashboard).

7.1   Dashboard Overview
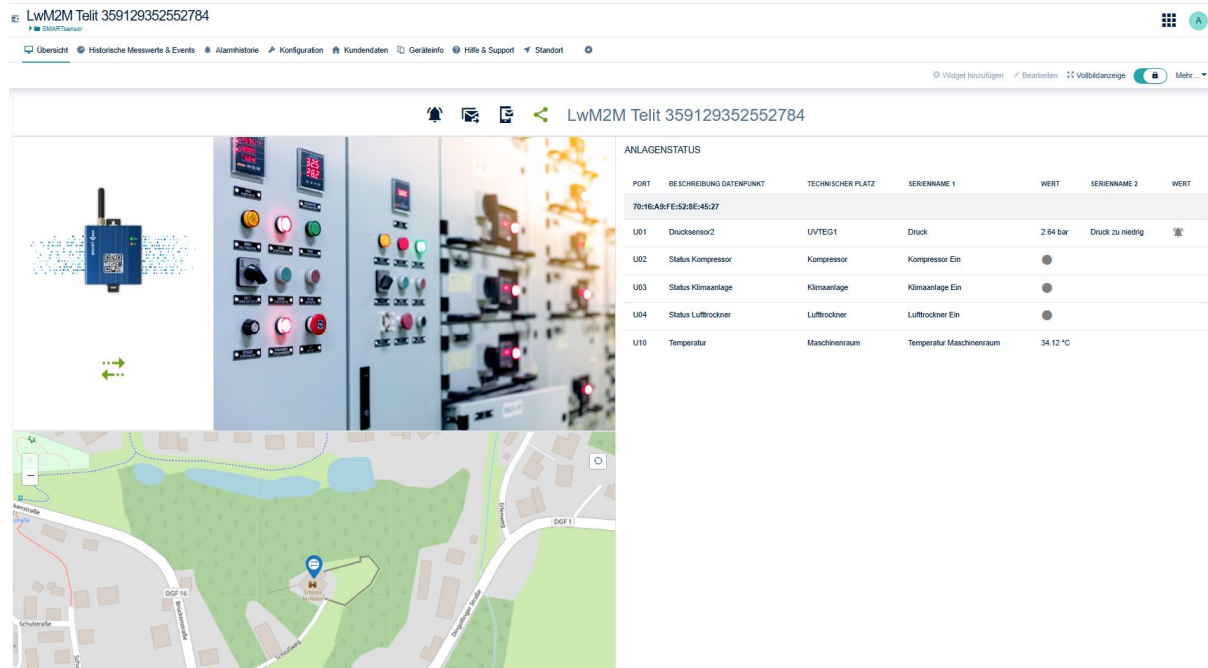
Here you will find a compact overview of the status of the system and current values of the sensors and connected Modbus values.

In addition, the current connection status is displayed below an image of the SMARTbox.

Below it is a map with the device location.

In addition, you have the option of storing a picture of your system in the middle.

8 Dashboard Alarm History

The **Alarm History Dashboard** is used to keep track of and track all alarms reported by a device. It is divided into three sections:

1. **Active alarms**
   - o Displays all currently pending alarms that have not yet been acknowledged or ended.
   - o If there are no active alarms, the message *"Do not show alarms"* appears.
2. **Confirmed alarms**
   - o Lists alarms that have been confirmed by a user but may still be active.
   - o This function is used to track the processing status.
3. **Deleted alarms**
   - o Here, completed or manually ended alarms are displayed chronologically.
   - o For each entry, the following information can be seen:
     - ▪ Alarm type (e.g. *pressure too low*)
     - ▪ Date and time of occurrence
     - ▪ Associated device (e.g. *LwM2M Telit [IMEI]*)

The dashboard supports the rapid detection of recurring problems (e.g. frequent underprinting) and serves as a proof log for error analysis or reporting.

Here you can get an overview of the triggered alarms.

By pressing the arrow to the right of each alarm, you can open a more detailed view.

By pressing on the 3 vertically arranged dots, you can confirm the alarm, cancel it or create a rule for alarms.

In the case of the alarm, the time and date, as well as the device name, are below the reason for the alarm.

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9 Dashboard Historical Metrics & Event

The **history dashboard** displays recorded metrics and events over a selectable period of time. It offers a combined visualization of measurement curves and operating states.

Content and features:

- Measured values (time series):
  - *Print* (purple line)
  - *Machine room temperature* (red line)
- Events & Conditions (colored bars):
  - Red: Pressure *too low* (alarm)
  - Blue: *Air conditioning On*
  - Yellow: *Compressor On*
  - Orange: *Air Dryer On*
- **Time Interval Selection:** Allows you to analyze any time periods (e.g., last day).
- Diagram:
  - X-axis: time course
  - Y-axis: temperature or pressure values

This dashboard is used to **analyze relationships between metrics and events**. For example, it can be seen whether pressure drops correlate with switching the compressor or temperature increases with the air conditioning system.

10 Modbus Configuration

Setting up the Modbus network with SMARTbox & CloudFieldbus (Cumulocity). The SMARTbox works as a Modbus master and can manage up to 32 Modbus slaves. All settings are made centrally in the Cumulocity cloud via the CloudFieldbus.

(1) Physical Cabling

- Each slave needs a **unique IP address and slave address**

```
[SMARTbox Client]——(Modbus Server)——[Slave 1]——[Slave 2]——... ——[Slave 32]
```

(2) Device modeling in the cloud

- A **device database** is created in *Device Management*:

  - Definition of Modbus registers (holding, input, coils).
  - Assignment of cloud types:
    - o **Measurement** → measured value
    - o **Event** → Event
    - o **Alarm** → fault message
    - o **Read/Write** → Parameterization
  - Once created, models can be applied to all smart boxes.

```
Cloud Device Management
   └── Device model "Counter XY"
   ├── Reg. 40001 → Measurement
              ├── Reg. 00010 → Alarm (malfunction)
              └── Reg. 40005 → Read/Write (Setpoint)
```

(3) Modbus dashboard in the cockpit

Each SMARTbox has its own **Modbus dashboard**:

1. **Configuring the network**
    - o Storing Slave and IP Address Address
    - o Select Device Model
2. **Configuring Transmission Intervals**
    - o *Polling rate*: polling frequency on the bus
    - o *Cloud Cycle*: Send Interval to the Platform
    - o Recommendation:
      - ▪ LTE ≥ 30 s
      - ▪ NB-IoT/LTEM ≥ 600 s

  ⚠ Note: *Polling rate + Cloud Cycle ≥ minimum time!*

(4) Summary

1. Check wiring

2. Configuring the Device Database
3. Configure Dashboard
4. Set expert settings (on demand)

10.1 Device modeling in the cloud

The configuration and creation of the Modbus registers to be queried is carried out in Device Management. We provide a number of device logs that you can use.

If a required device log is not available, you can create your own. Please refer to the Cumulocity documentation.

If an existing device log does not contain all the desired registers, you can export it, import it under a new name, and edit it. You can find out how export and import work in the Cumulocity documentation .

To learn how to assign the device logs to your device, see Chapter 4.3.4.

⚠ You can only edit logs that you have created.

⚠ When adding or editing data points, keep in mind that the "Show Status" checkbox should only be used for status values that do not change frequently. Any change to a value for which "Show Status" is active will immediately send all values that have selected "Show Status" and thus possibly lead to a high consumption of data volume.

10.2 IT Network

The network interface is configured using Object 34723 using the following resources:

DHCP_DISABLE	MODBUS_IP	MODBUS_IP_GATEWAY
MODBUS_DHCP_DISABLE ⓘ [1 ⇕] [Schreiben]	**MODBUS_IP** ⓘ [---\u0000] [Schreiben]	**MODBUS_IP_GATEWAY** ⓘ [---\u0000] [Schreiben]
Determines whether DHCP should be used. 0- DHCP enabled 1- DHCP disabled	The IP address to be used by the device. Used only when DHCP is disabled.	The IP address of the gateway to be used
MODBUS_SUBNETMASK	MODBUS_ACTUAL_IP	
MODBUS_SUBNETMASK ⓘ [255.255.255.0\u0000] [Schreiben]	**MODBUS_ACTUAL_IP** ⓘ [---\u0000]	

The subnet mask to use.	This resource cannot be described. To retrieve the value from the device, click on the ⋮ button on object 34723 and then click on 🔲 Objekt lesen
	
	[🔷 object_34723 /34723/0 ⋮]
	      🔲 Objekt lesen
	   🔷 object_34730 /34730/0
	      🔲 Instanz lesen	

10.3 Modbus Network and Transmission Intervals

(1) Modbus Network: Device protocols are assigned in the <u>cockpit</u> on the SMARTbox dashboard. Navigate to your device and go to the dashboard

.

Modbus devices can be added in the section. A name, the corresponding device protocol, and the individual address for each device (1-245) must be assigned. In addition, Snipping cycle and Cloud cycle can be set here.

Important: Add the device and then save it!

(2) Transmission intervals
All data points defined as measurement in the device database are sent to the platform in the specified transfer cycle (see settings below), while all other data points (**event, alarm, status, read/write**) are **only transmitted when there is a change and** regardless of the settings mentioned below.

	Click
Modbus TCP	[⊕ Add TCP communication]
	Give the device a name.
	Select the device protocol.
	Enter the Modbus address.
Name Device type Address IP address	Click [Hinzufügen]
RevPi-NRGY EFP_001 1 10.4.82.18	
[Save] [⊕ Add TCP communication]	
Modbus communication	*Polling rate*: polling frequency on the bus
	Cloud Cycle: Send Interval to the Platform
Snipping Cycle Supported fieldbus version	Recommendation:
3600 seconds 5	LTE ≥ 30 s
Cloud Cycle	NB-IoT/LTEM ≥ 600 s
0 seconds	
[Save]	

⚠ : If you edit the device log after it has been assigned to the device, it will need to be downloaded to the device again. To do this, remove the device log from the list of associated logs and reinsert it. Depending on the device configuration and mobile phone reception, this process can take up to 15 minutes.

10.4 Expert settings

The expert settings of the Modbus interface are done using objects 34723 (TCP).

In the expert settings, you can define global defaults for all Modbus slaves connected to a SMARTbox:

- 32-bit data types: If data points are defined as 32-bit in the device model, the interpretation (float, integer) can be changed centrally.
- Query type: You can choose whether the configured registers are queried as a batch (several registers in a block) or individually. Some Modbus slaves do not support batch reading and require individual queries.

ENABLE	MODBUS_VALUE_FORMAT	MODBUS_TRANSFER_TYPE
ENABLE ⑦ 0 [↕] Schreiben	MODBUS_VALUE_FORMAT ⑦ 0 [↕] Schreiben	MODBUS_TRANSFER_TYPE ⑦ 0 [↕] Schreiben
Activating or deactivating the Modbus function. 0- Deactivated 1- Enabled (default)	Determines which data type the Modbus registers should be interpreted as. 0- DINT 1- FLOAT (REAL) Note: Only data points of type DINT or FLOAT can be read at a time. Not both at the same time.	Determines whether multiple write of registers is supported. 0- FC15/FC16 is supported 1- FC15/FC16 is not supported

10.5 Display in the platform

The assignment of cloud types in the device database model determines the representation:

- **Measurement** → Tab *Measurements*
- **Event** → Events tab
- **Alarm** → Tab Alarms
- **Read/Write** → visible via *Modbus Field I/O widget*

```
[SMARTbox] → [CloudFieldbus] → [Cumulocity Cockpit]

Measurement → Measurements Tab
Event       → Events Tab
Alarm       → Alarms Tab
R/W Param.  → Modbus Field I/O Widget
```

Measured values are sent **periodically**.
Events are sent when the **value changes**.
Alerts are sent when the **value changes**.
Status Read/Write values are sent when the **value changes**.

⚠ **:** Values that change frequently should not be configured as an event, alarm, or status, otherwise they will be sent to the cloud every second. This leads to a very large data consumption and associated costs.

11 Customer Data Dashboard

The **customer data dashboard** provides a central overview of a plant's master data.

Functions:

- **Left:**
  - o Possibility to upload an *attachment image* for better visual identification.
  - o Below this is the **file storage**, where maintenance reports, logs or other relevant documents can be stored.
- **Right side:**
  - o Display and editing of **system name** and **location data** (address, zip code, city, country, street).
  - o The *"Edit"* button can be used to make changes.
  - o **Important:** You must save after each adjustment, otherwise changes will be discarded.

This dashboard makes it easy to **document and manage asset data** , ensuring that both visual information and relevant documents are available in one central location.
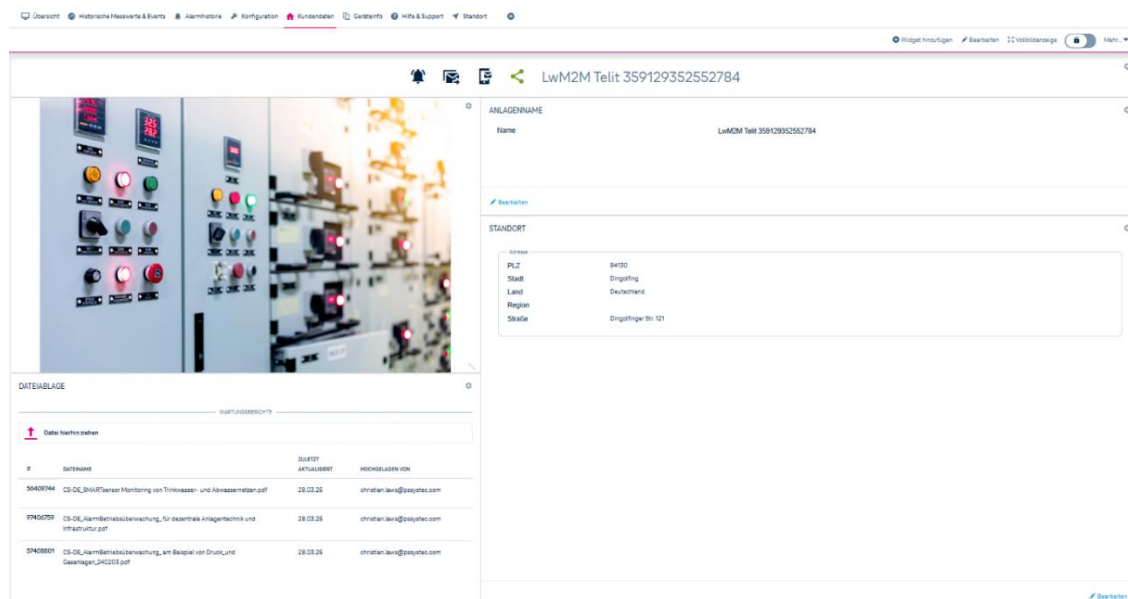

12 Device Info Dashboard

The **Device Info Dashboard** displays technical details and status information about the connected SMARTbox.

Functions:

- Left:
    - o Display of the SMARTbox with display of the current **connection status** (symbol below the device).
- Right side:
    - o **Device data:**
        - ▪ Serial number
        - ▪ SIM card number
    - o **Software & Firmware:**
        - ▪ Installed software version
        - ▪ Current firmware version

This dashboard enables quick **identification of the device** as well as control over the software versions used and the network connection.
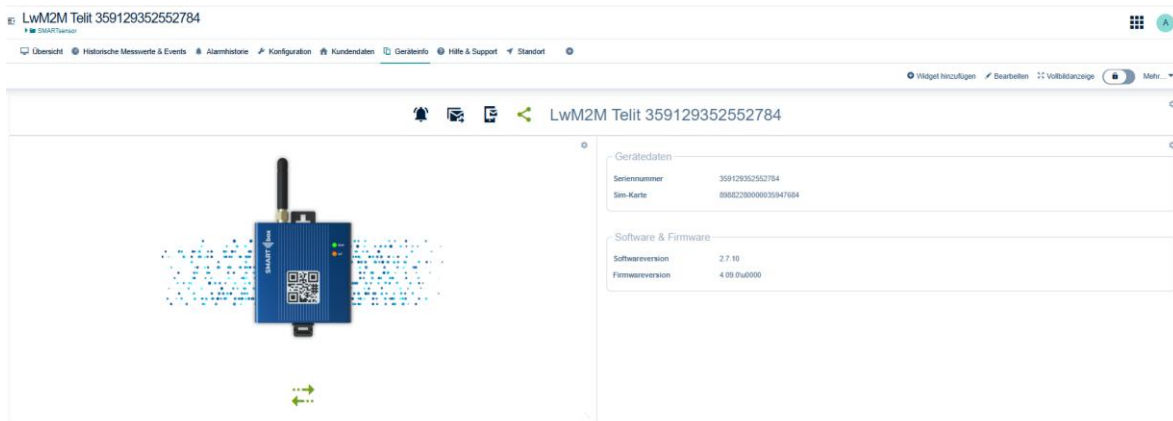
13 Help and Support

The Help **& Support dashboard** provides users with direct access to manuals and customer support.

Functions:

- **Left:**
    - Download the current *user manual*.
    - Access to the **file repository** with maintenance reports or additional documentation.
- **Right side:**
    - Integrated **help desk** for support requests.
    - Possibility to create a ticket directly to PSsystec customer service.
    - Input fields for:
        - Sender (Requester)
        - Subject
        - Problem description (with formatting options)
        - Type, priority, and product assignment

⚠ **Important:** Please provide as precise a description of the problem as possible as well as the **serial number of the device** to ensure quick processing by support.